SCIENTIFIC COMMUNICATION

Silver Membrane Filters as a Support for Infrared Analysis by Attenuated Total Reflection

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SIR: Membrane filters have been shown to provide a facile means of preparing a suspension for infrared analysis by attenuated total reflection (ATR) (1). The primary objection to this technique is that the background spectrum of the cellulose-based filters requires either reference beam compensation or an adequately thick suspension which guarantees total coverage of the filter. The reference beam compensation requires a second ATR accessory with appropriate adjustment of the angle of incidence so that the depth of penetration just compensates for the sample beam interference.

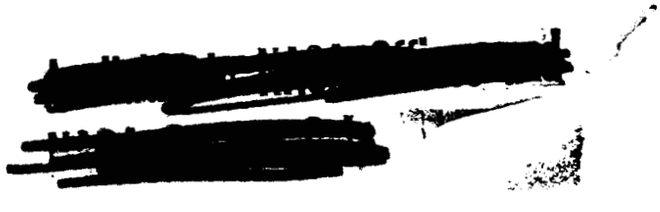
The heavy suspensions preclude microanalysis. This paper presents data on the use of newly available silver membrane filters for IR-ATR analysis.

EXPERIMENTAL

The filters used were Millipore HAWP, cellulose esters; Gelman GM-6, cellulose acetate: and Selas FM47, silver metal; all with 0.45 micron pores. The spectra were run on a Perkin-Elmer 621 grating spectrophotometer with a RIIC-Limit single reflection ATR-5 with a KRS-5 crystal set to an angle of incidence of 40°.

RESULTS AND DISCUSSION

Figure 1 presents the spectrum of the membrane filters and the strong bands from the cellulose-based filters as contrasted with the absence of bands in the ATR spectrum of the silver filter. Figure 2 presents the spectrum of a dilute filtered suspension of the bacterium Clostridium novyi on the cellulose and silver filters. With the



cellulose-based materials, the spectrum is barely discernible against the strong background but is readily apparent without interference when on the silver filter.

The lack of interference from the silver is due either to a lack of spectral features or to a difference in refractive index of the silver and the resulting change in critical angle and reflection parameters.

It is to be noted that the polarization effects (2,3) due to the grating-ATR interaction is accentuated with the silver filter, particularly at the order change at 2000 cm^{-1}. This interference can be removed by readjustment, if necessary, at filter, order, and grating changes.

The 4000 to 2000 cm^{-1} range is typically weak under our experimental conditions with both types of filters. The region 600 to 200 cm^{-1} is subject to more severe interference with the silver filter and is not conducive to the analysis.

The technique of using silver membrane filters as a means of suspending particulate matter from suspensions for ATR analysis without interference and without tedious compensation techniques should be extremely useful, particularly in biological investigations.

LITERATURE CITED

(1) Hannah, R. W., Dwyer, J. L., ANAL. CHEM. 36, 2341 (1964).

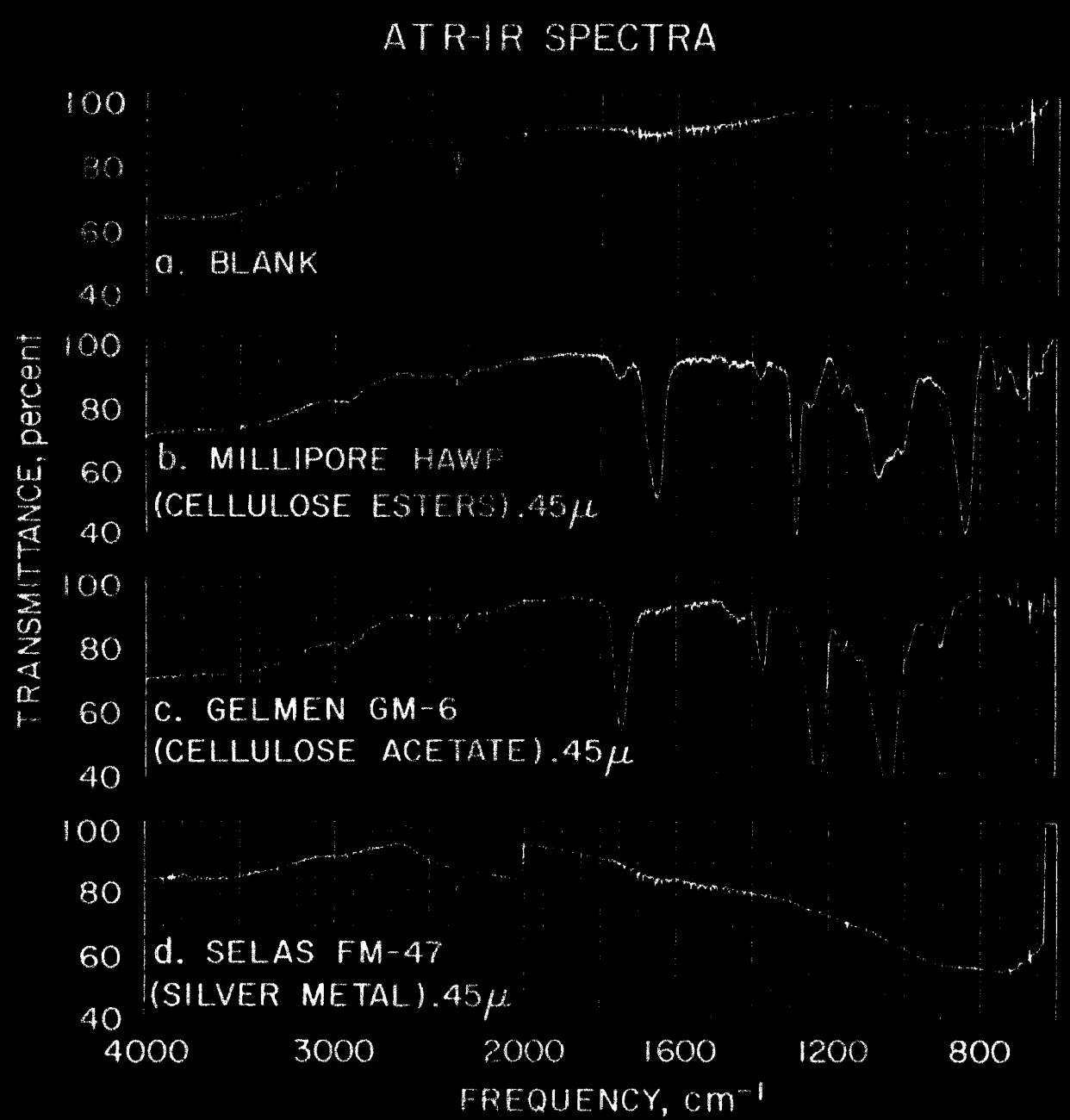
(2) Hidalgo, A., Pastor, J., Serratosa, J. M., J. Opt. Soc. Am. 52, 1081 (1962).

(3) Rawlins, T. G. R., Ibid., 54, 423 (1964).

FIGURE LEGENDS

Figure 1. ATR-IR spectra.

Figure 2. ATR-IR spectrum of *Clostridium novyi*.


ATR-IR SPECTRA
TRANSMITTANCE, percent
100
80
60
40
a. BLANK
b. MILLIPORE HAWP
(CELLULOSE ESTERS).45μ
c. GELMEN GM-6
(CELLULOSE ACETATE).45μ
d. SELAS FM-47
(SILVER METAL).45μ
4000
3000
2000
1600
1200
800
FREQUENCY, cm⁻¹

ATR-IR SPECTRUM OF CLOSTRIDIUM NCVYI